



Overview:

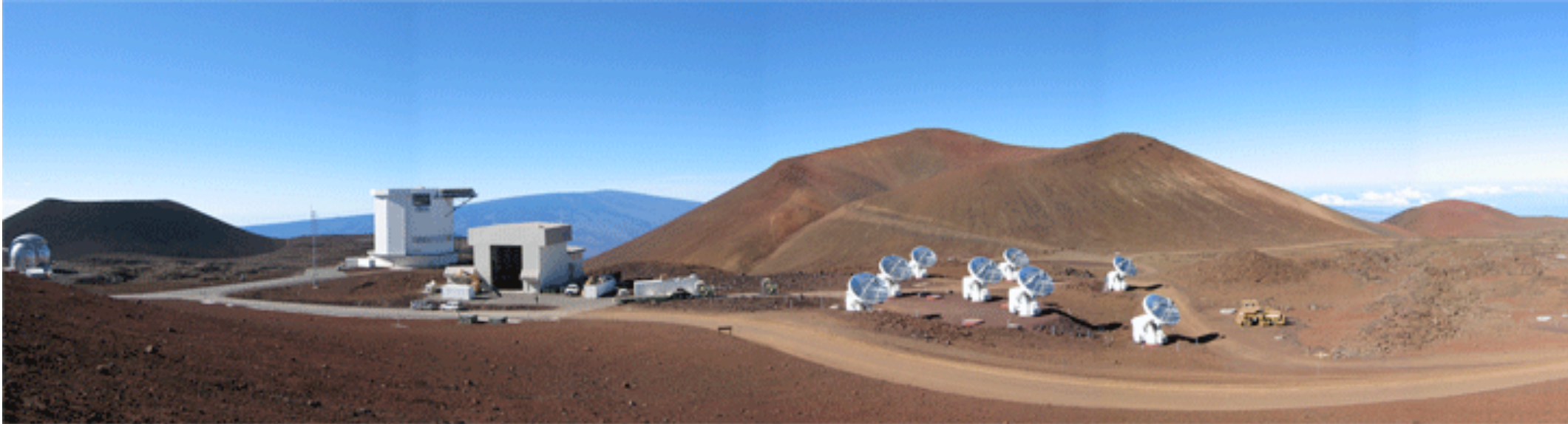
Radio Astronomy in US or

US Astronomy at radio wavelengths

Fred K. Y. Lo

魯國鏞

US Radio Astronomy



US Radio Astronomy Community

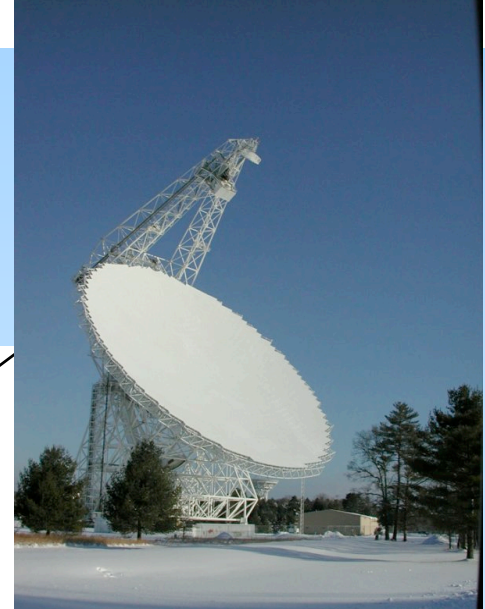
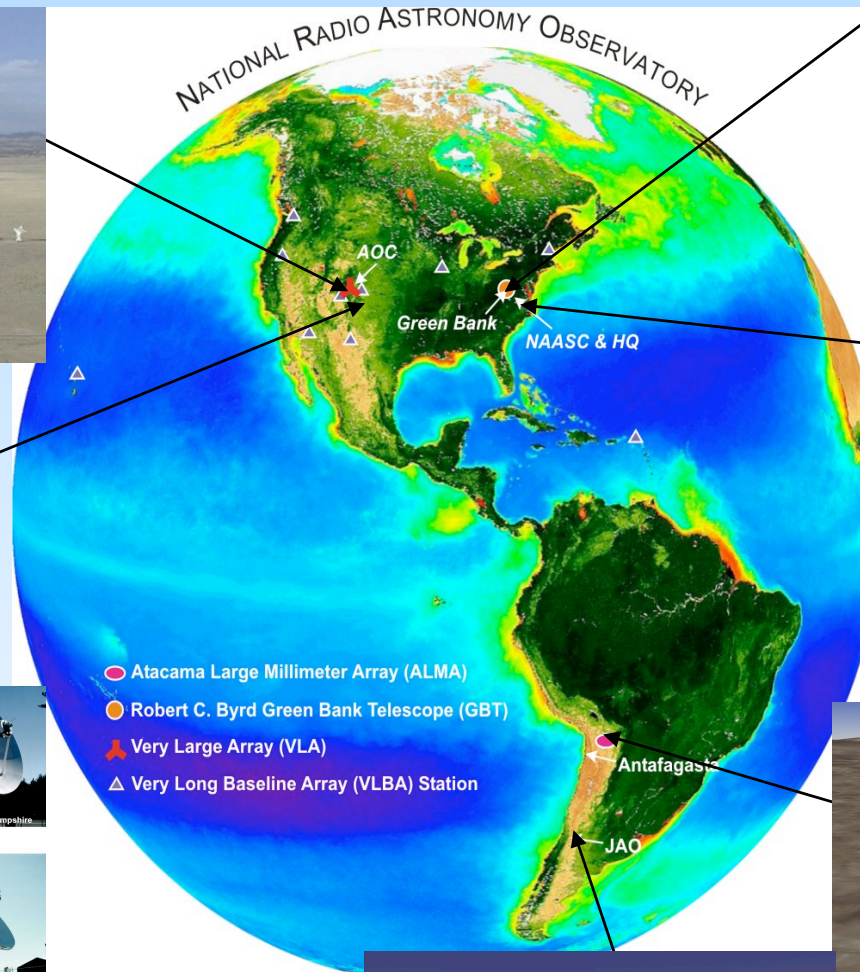
- Harvard/SAO
- MIT
- U Mass
- Maryland
- Princeton
- Columbia
- Yale
- Illinois
- Michigan
- Wisconsin
- Iowa
- Cornell
- Virginia
- Virginia Tech
- U Penn
- Colorado
- UT Texas
- Rochester IT
- New Mexico
- NMT
- Minnesota
- UC Berkeley
- Caltech
- UCLA
- West Virginia
- Rutgers
- +
- Naval RL
- Naval Obs.
- JPL & GSFC
- SETI

NAIC: Arecibo

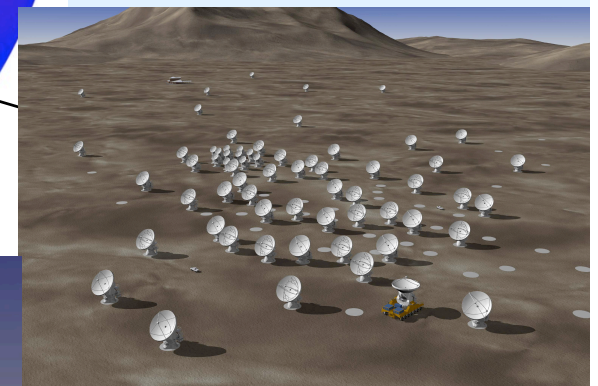
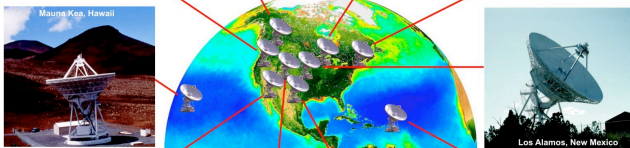




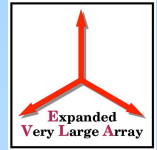
A Complementary Suite of Telescopes in 2013: Open Skies Policy



ALMA in 2013



Joint ALMA Obs. ⁵



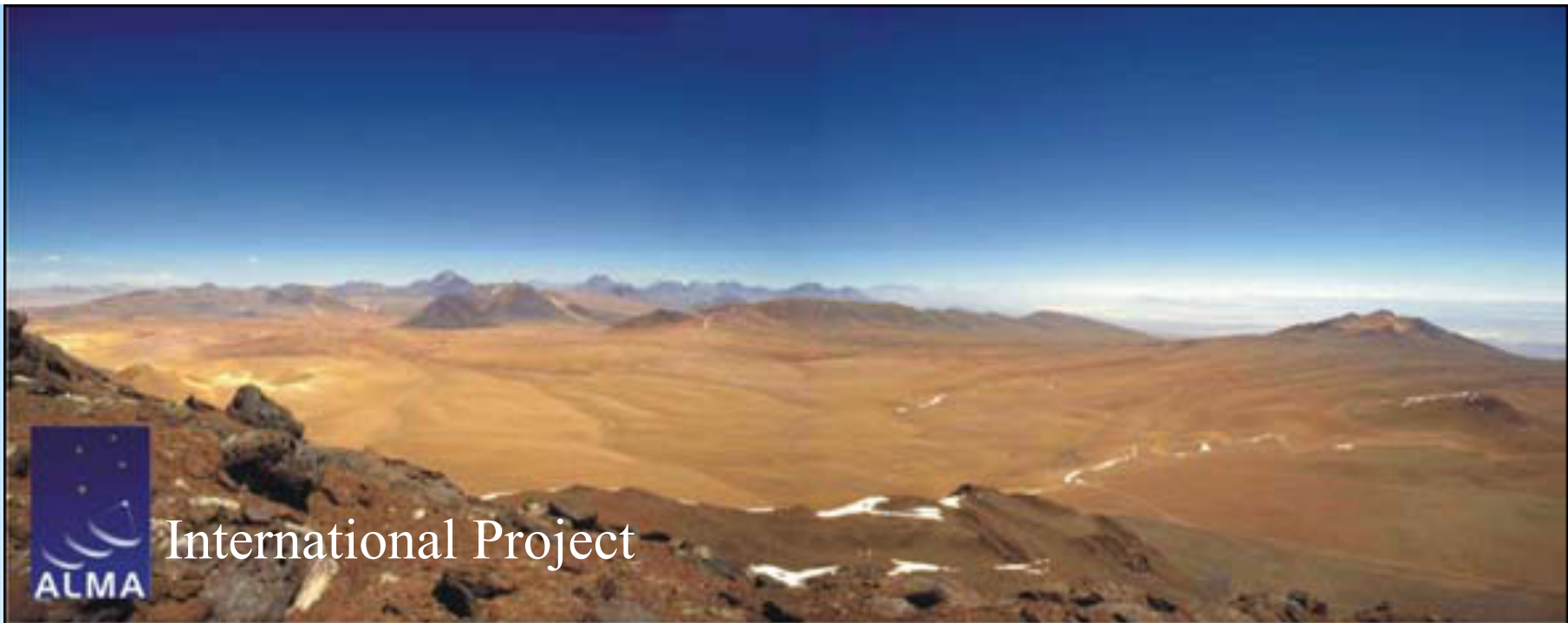
EVLA: A Major New Facility

SKA Demonstrator!

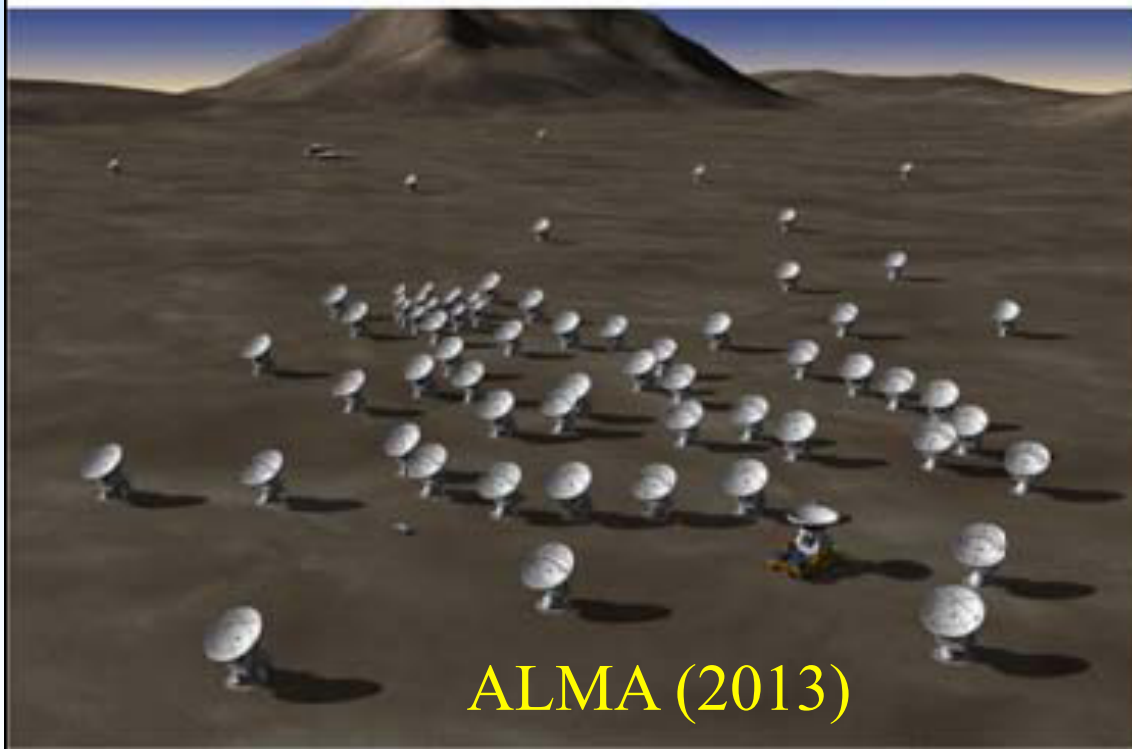
(2003 - 2012)



- Modernizing all the electronics of VLA
- 10-fold increase in sensitivity
- As scientifically powerful as ALMA
 - in cm wavelengths
- First Science 2010



International Project



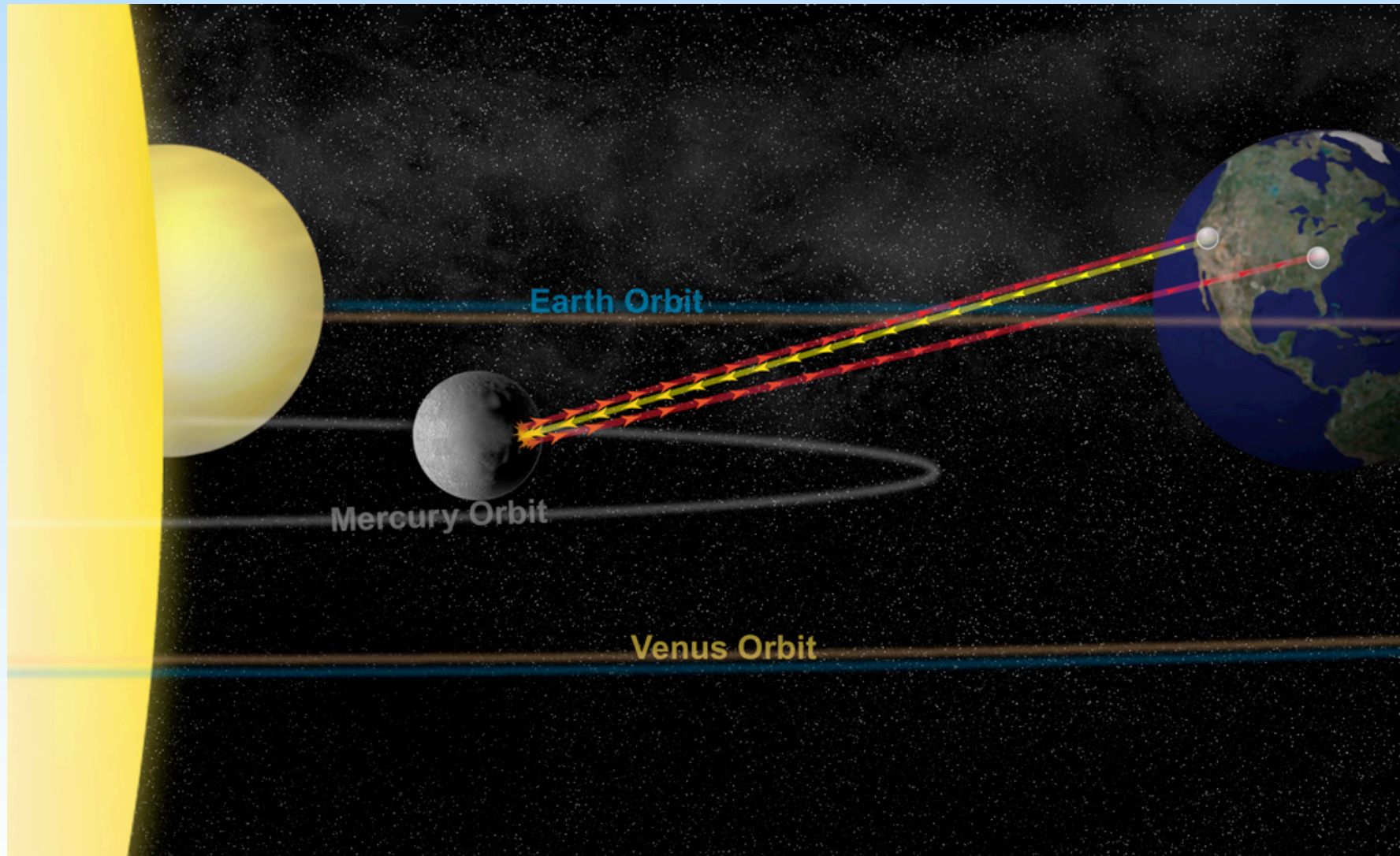
ALMA (2013)



Molten Core of Mercury

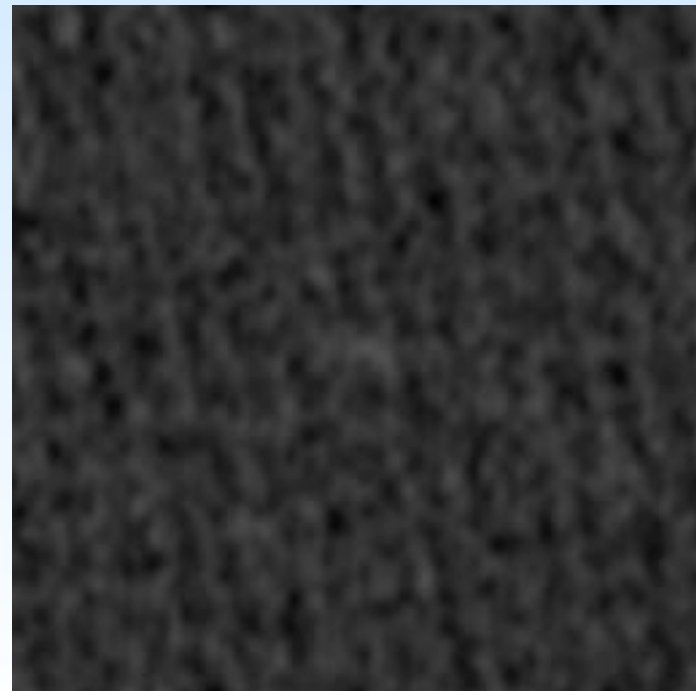
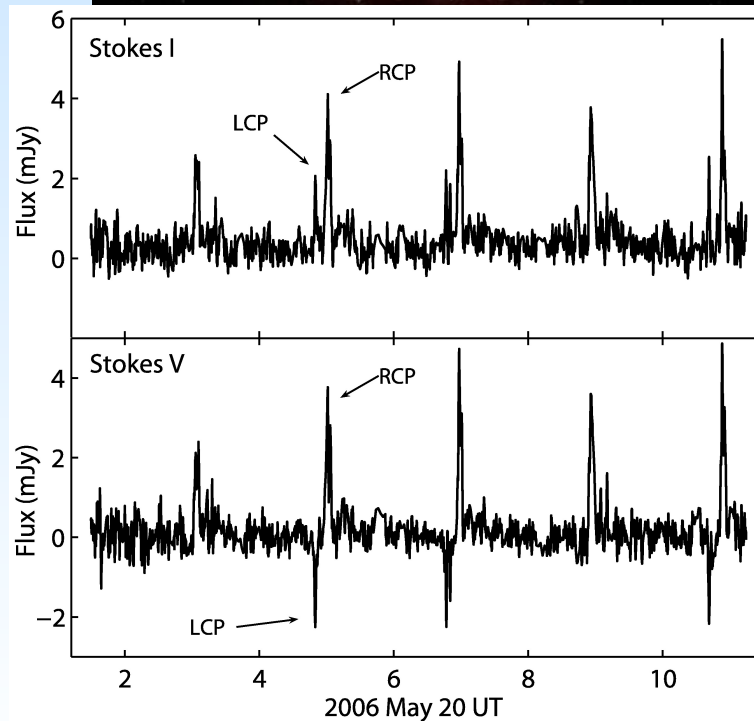
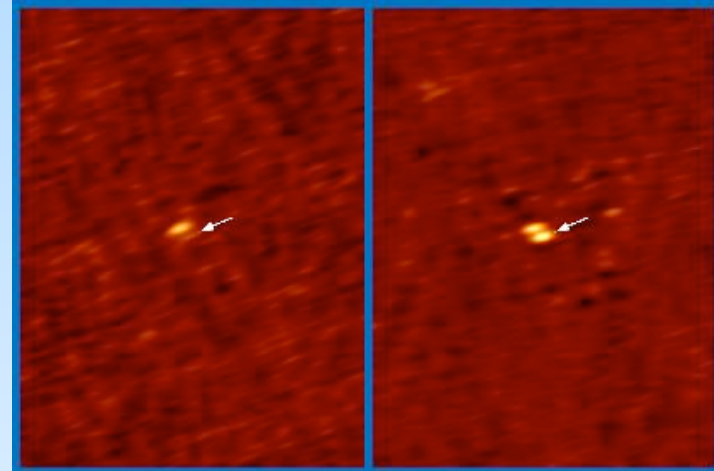
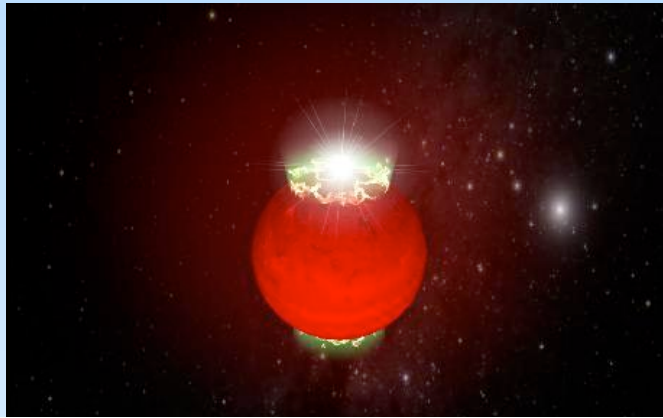
Goldstone, GBT & Arecibo

(J-L Margot et al 2007)



VLA: A Brown Dwarf Radio Light-house

(Hallinan et al 2007ApJL 663 L25)

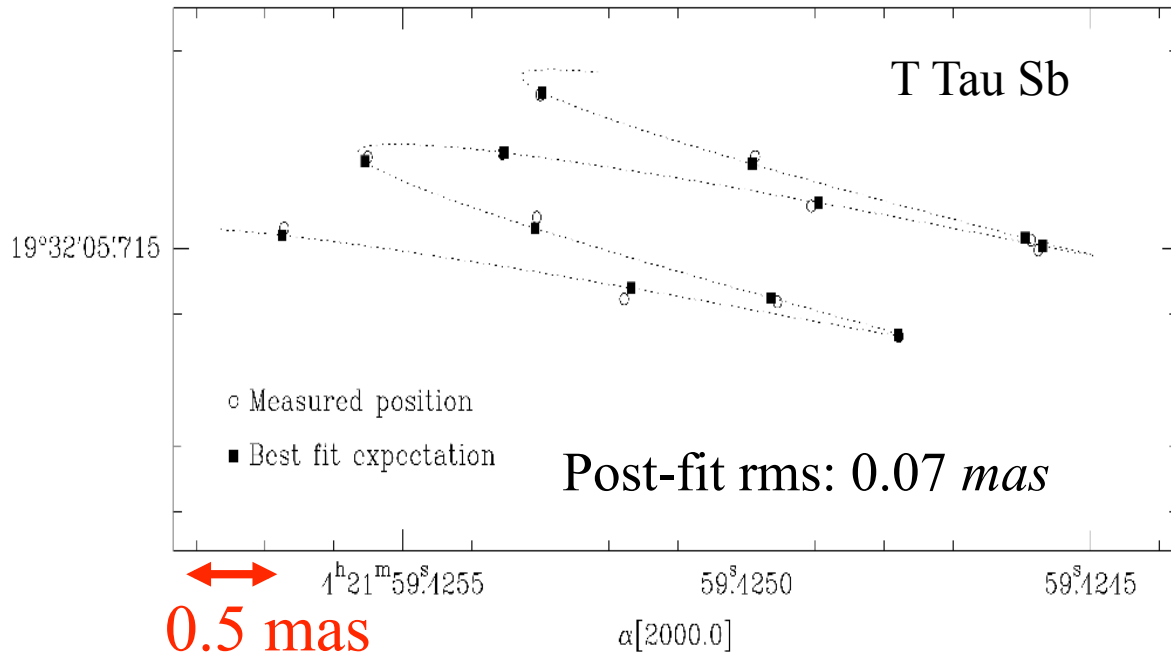


VLBA: PMS Stars Parallax and Proper Motion

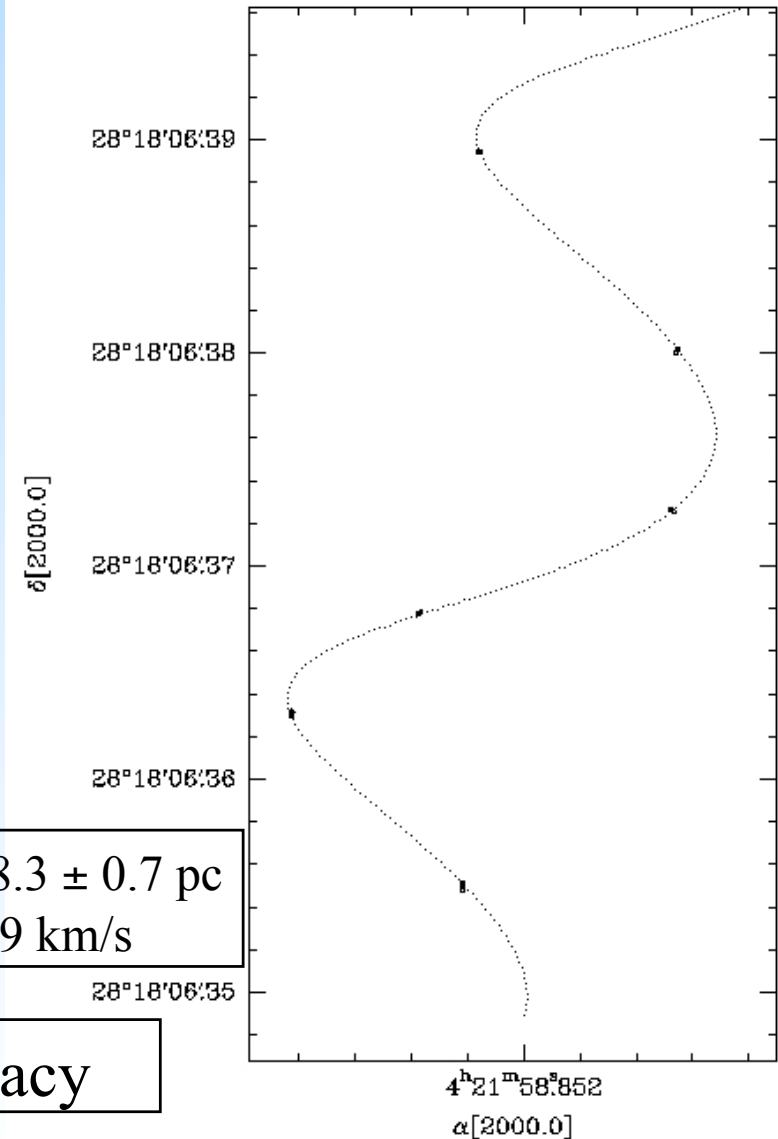
(Mioduszewski, Loinard et al 2007)

Parallax and proper motion of T Tau S

dist = 149.2 +/- 0.8 pc



Parallax and proper motion of HDE283572



Proper motion: $V = 2.9$ km/s

Distance:

$$D = 149.01 \pm 0.73 \text{ pc}$$

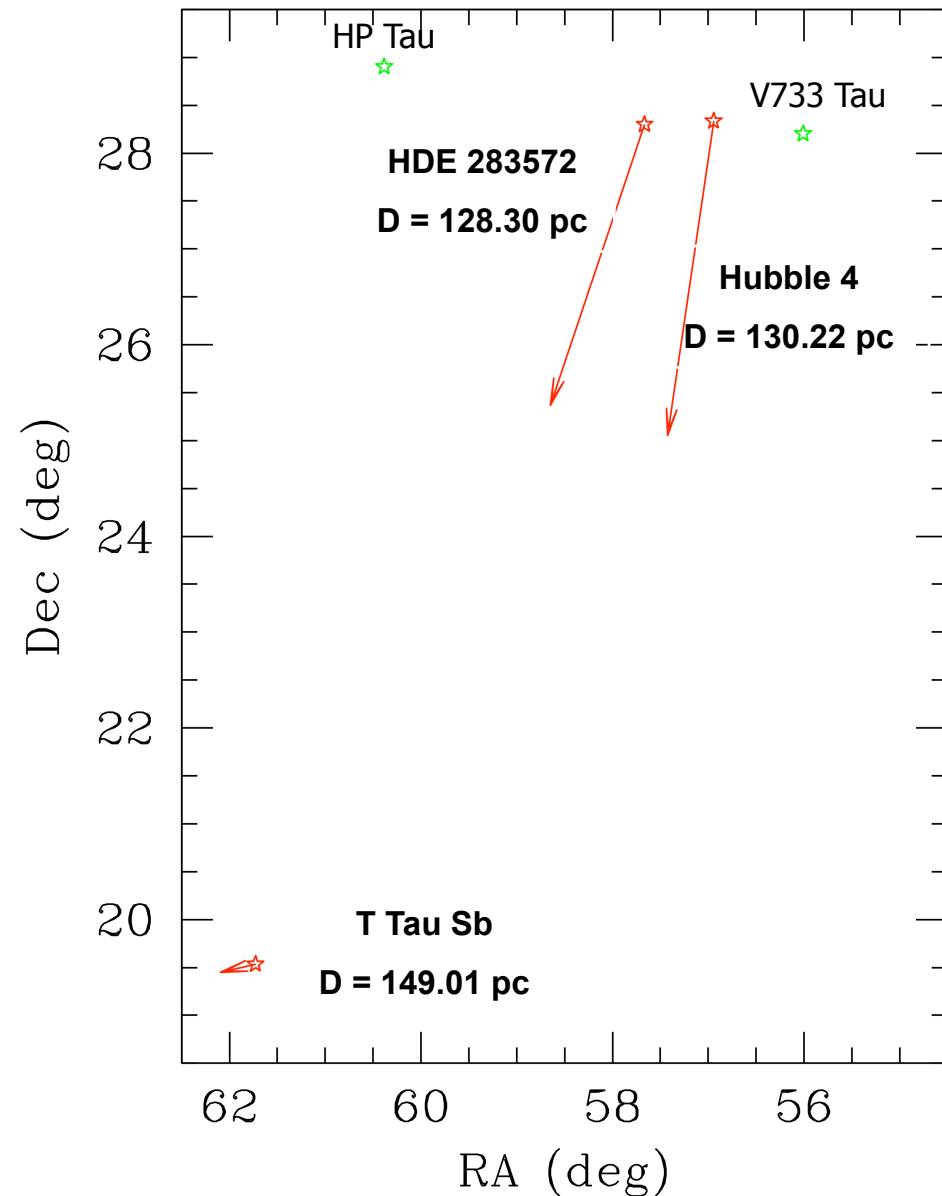
$$D = 128.3 \pm 0.7 \text{ pc}$$

$$V = 16.9 \text{ km/s}$$

0.5% accuracy

Ultimate goal:
3D dynamic map of a
star-forming region.

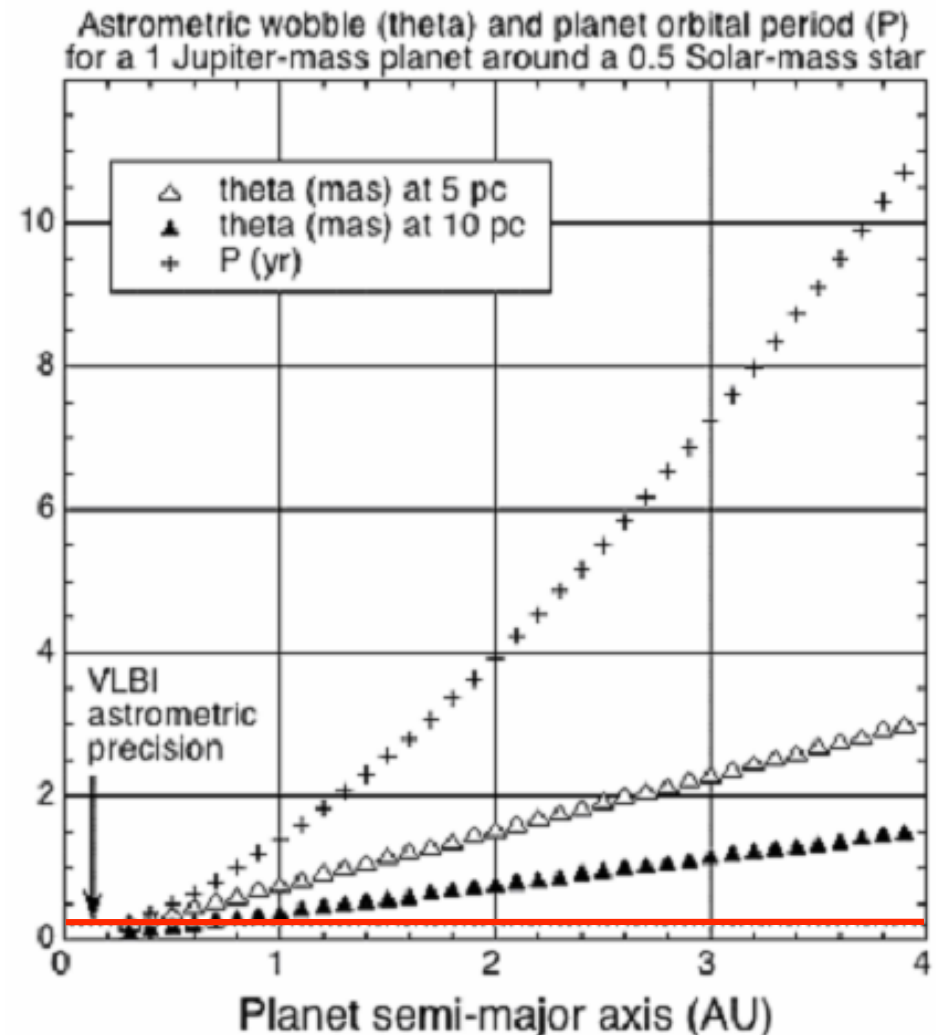
Next step:
Look for recoil motion of
PMS stars to exo-planets.
Expect 50-100 μsec ,
which is doable with VLBA.



RIPL: Radio Interferometric Planet Search

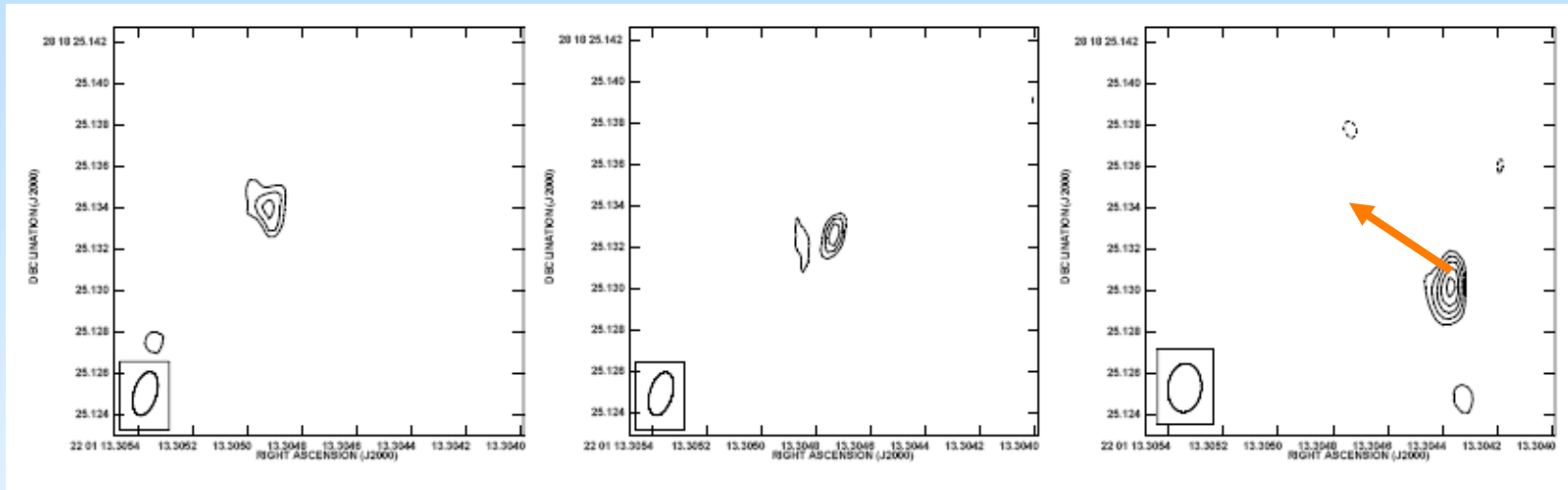
(G. Bower, UC Berkeley)

- Detect Jupiter mass planets around nearby low mass stars through astrometric wobble
- 32 stars
 - M1 – M8
 - $D = 2.7 - 9.5$ pc
 - 11 are members of known binary or multiple systems
- 12 epochs/star/3 years
 - VLBA + GBT
 - 512 Mb/s
 - 1392 hours total



Preliminary Results: Proper Motion of GJ 4247

15 mas



26 March

25 March

23 March

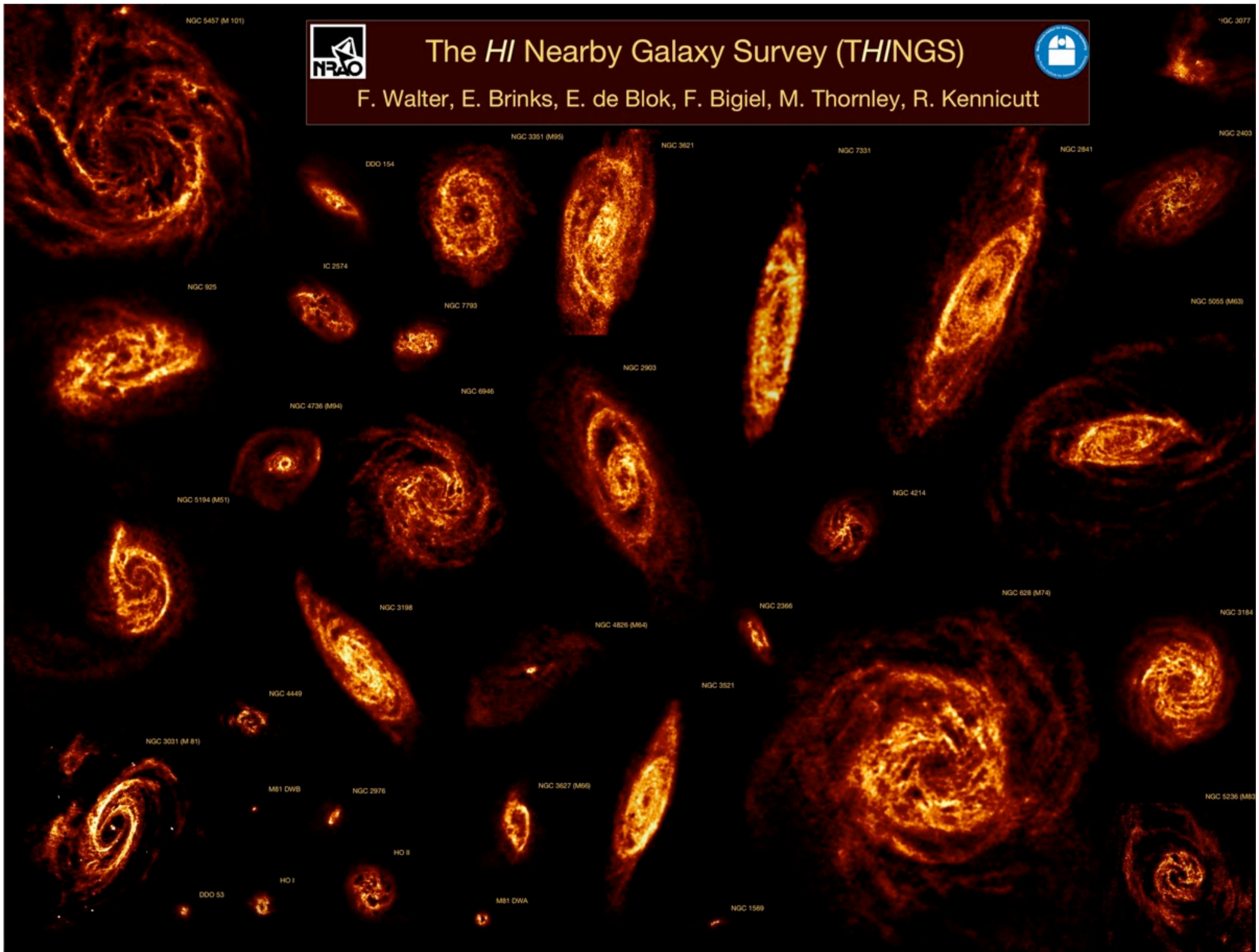
← Motion = Sum of Proper Motion and Parallax



The *HI* Nearby Galaxy Survey (*THINGS*)

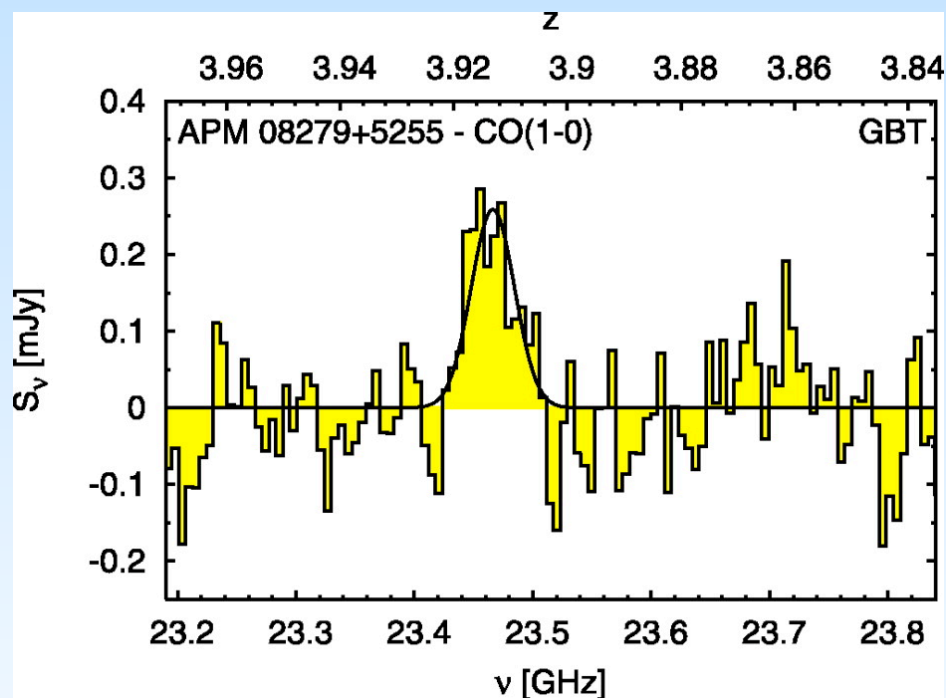
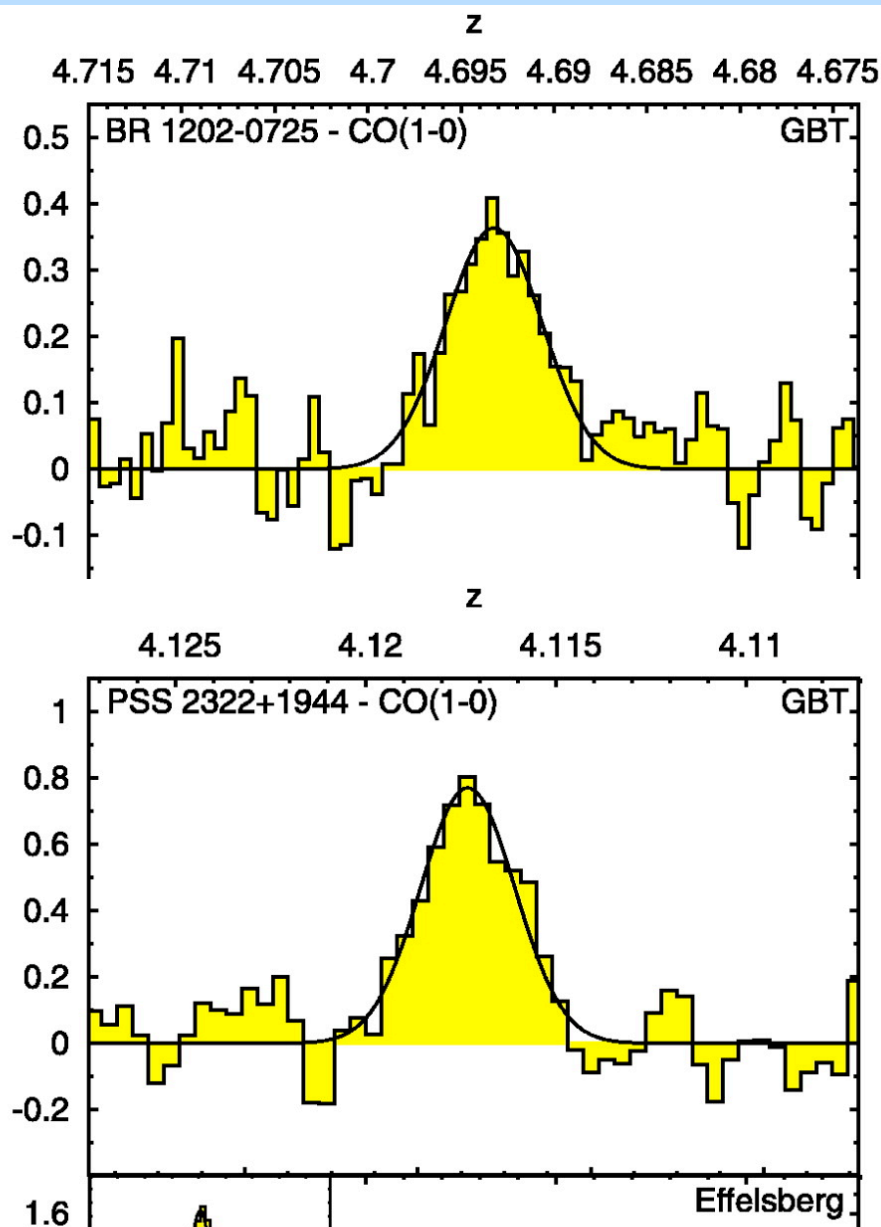


F. Walter, E. Brinks, E. de Blok, F. Bigiel, M. Thornley, R. Kennicutt

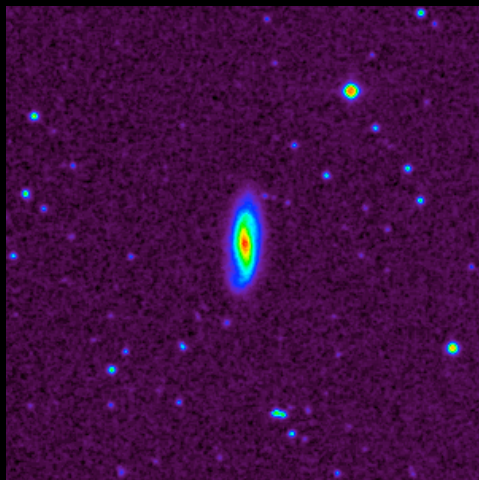


GBT: CO(1-0) in $z \geq 4$ Quasar Host Galaxies

Riechers et al, ApJ 650:604-613, 2006

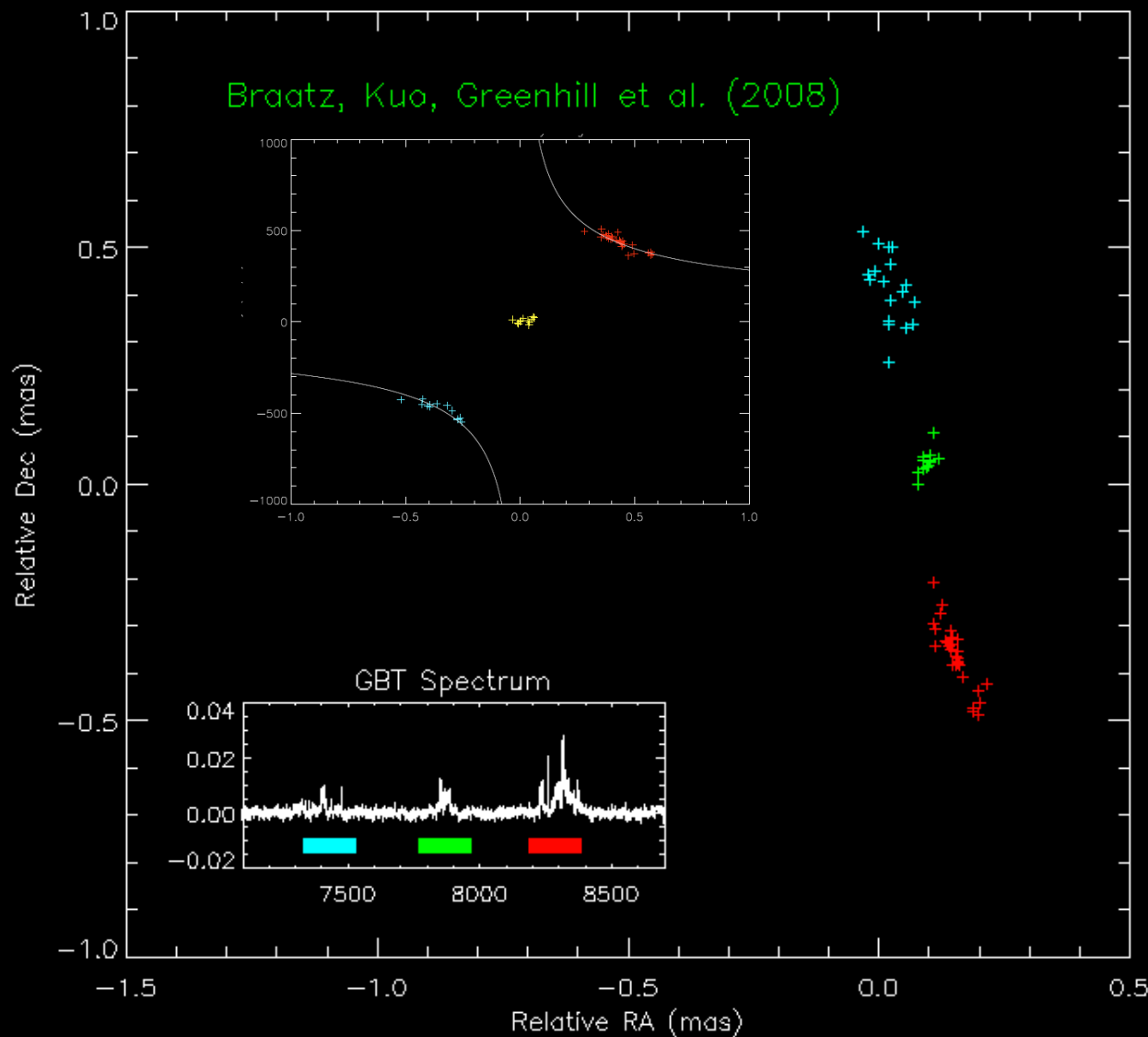
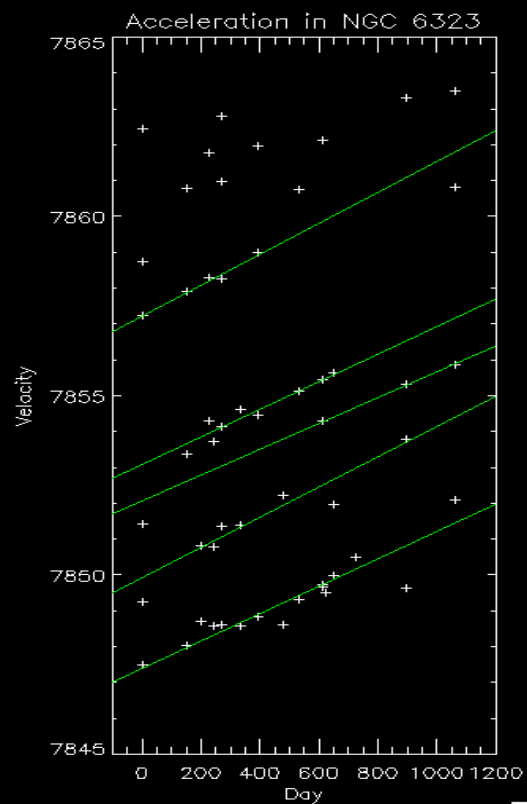


NGC 6323 at $V_r \approx 7900$ km/s (~ 100 Mpc) (Braatz et al 2008)



H2O Masers in NGC 6323 – VLBA+GBT+Eff

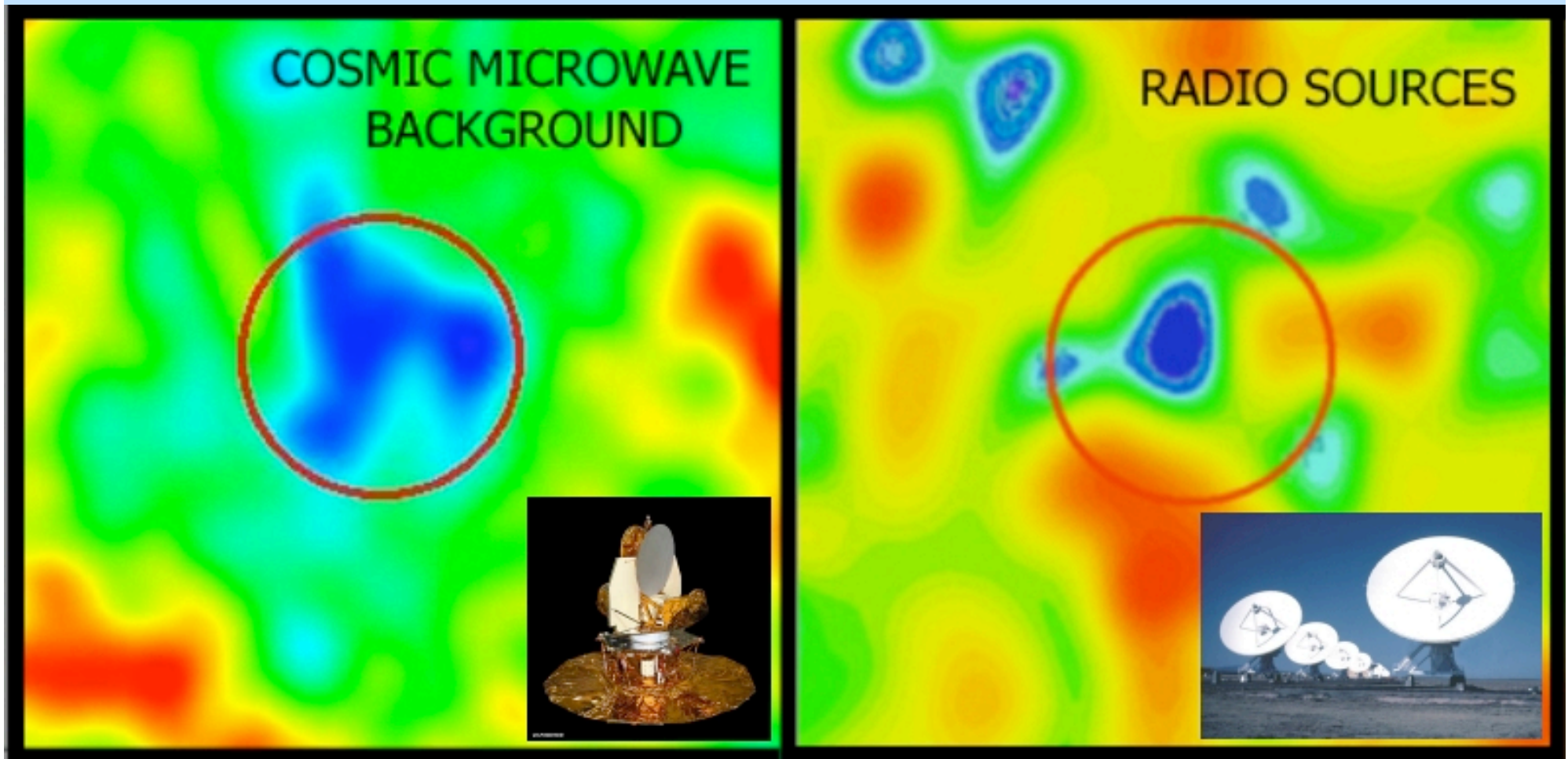
Braatz, Kuo, Greenhill et al. (2008)



Integrated Sachs-Wolfe Effect

“Hole in the Universe”

(Rudnick et al 2007)



Opportunities of Collaboration

- Astronomy is very international
 - VLBI, ALMA, SKA
 - NRAO is in practice an International Observatory
- China-US collaborations in Radio Astronomy largely individual and informal in the past
- Main goal of Bilateral Workshop is to explore enhanced China-US collaborations
- Collaborations are all personal in the end
 - ⇒ To get to know each other!

as Prof. Chen said: To know “who’s who” !